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PATENT  
33379US1(148341NM)(12553-1115)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Sunyu Su et al. :  
Serial No.: 10/085,347 : Art Unit: 3737  
Filed: February 27, 2002 : Examiner: Eleni M. Mantis Mercader  
For: UNEVEN-COUNTER- :  
ROTATIONAL COIL BASED :  
MRI RF COIL ARRAY :

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- Appellants' Brief (21 pgs.)
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Respectfully submitted,

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**TRANSMITTAL LETTER ACCOMPANYING APPEAL BRIEF**

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Commissioner of Patents  
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Transmitted herewith is the Appeal Brief in this application. The Commissioner is authorized to charge the \$500.00 fee for filing this Appeal Brief, pursuant to 37 CFR 41.20(b)(2), to Deposit Account 070845. A duplicate copy of this transmittal letter is submitted for that purpose.

The Notice of Appeal in this Application was mailed on **October 27, 2005**. As indicated in the enclosed Certificate of Mailing by Express Mail, the Appeal Brief is being deposited with the U.S. Postal Service "Express Mail Post Office to Addressee" service (**Express Mail Label No. EV 679303695 US**), on **December 27, 2005**.

In the event of overpayment or underpayment, please credit any excess or charge any deficiency to Deposit Account No. 01-2384. A duplicate copy of this transmittal letter is submitted for that purpose.

Respectfully submitted,

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**APPELLANTS' BRIEF**

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Alexandria, VA 22313-1450

The Notice of Appeal in this Application was filed on October 27, 2005.

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## **Table of Contents**

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- VII. Argument
- VIII. Appendix of Claims Involved in the Appeal

No Evidence Appendix and no Related Proceedings Appendix are part of this appeal brief.

**I. REAL PARTY IN INTEREST**

The real party in interest in this appeal is General Electric Company, 1 River Road,  
Schenectady, New York 12345.

## **II. RELATED APPEALS AND INTERFERENCES**

There are no related appeals or interferences which will directly affect, or be directly affected by, or have a bearing on, the decision in this pending appeal.

### **III. STATUS OF CLAIMS**

Presently, claims 1-20 are pending in the subject application and are on appeal. Claims 1-20 stand rejected.

**IV. STATUS OF AMENDMENTS**

A Notice of Appeal was filed on January 4, 2005 and an Appeal Brief in support thereof was filed on May 4, 2005. A Final Office Action was mailed July 27, 2005 in response to the Appeal Brief, which reopened prosecution to address all relevant claims and maintained the final rejection of all pending claims.



## **V. SUMMARY OF THE INVENTION**

The following summary does not limit, in any manner whatsoever, the claim interpretation. Rather, the following summary is provided only to facilitate the Board's understanding of the subject matter of this appeal.

Various embodiments of the invention relate to a magnetic resonance imaging (MRI) coil array that generates a quasi-one-peak sensitivity profile. More specifically, the invention is defined claim-by-claim as set forth below.

Independent claim 1 recites an MRI RF coil array that comprises a first coil 12 having a null  $B_1$  point and a quasi-one-peak sensitivity profile with only one peak (page 4, lines 15-17 and page 4, line 30 to page 5, line 2 of the specification; and Fig. 2D). The MRI coil array also comprises a second coil 14 oriented with respect to the first coil to reduce coupling (page 5, lines 3-6 of the specification).

Claim 2 depends from claim 1 and further recites that the second coil is within the first coil (page 6, lines 21-26 of the specification).

Claim 3 depends from claim 1 and further recites that the second coil overlaps the first coil (page 6, lines 21-26 of the specification).

Claim 4 depends from claim 1 and further recites that the second coil is cascaded with the first coil (page 6, lines 21-26 of the specification).

Claim 5 depends from claim 1 and further recites that the second coil is solenoidal (page

5, lines 15-17 and page 6, lines 21-26 of the specification).

Independent claim 6 recites a MRI coil array that comprises a first solenoidal coil 12 having a first section (first coil section A) and a second section (second coil section B), with the first section having more turns than the second section (page 4, lines 16-18 of the specification). The second section has a counter-rotational orientation with respect to the first section (page 5, lines 18-19), and the first coil has a quasi-one-peak sensitivity profile with only one peak (page 4, line 30 to page 5, line 2 of the specification; and Fig. 2D). The MRI coil array further comprises a second solenoidal coil 14 being oriented with respect to the first coil to reduce coupling (page 5, lines 3-6 of the specification).

Claim 7 depends from claim 6 and further recites that the second coil is oriented between the first and second sections (page 6, lines 21-26 of the specification).

Claim 8 depends from claim 6 and further recites that the second coil is oriented about the second section (page 6, lines 21-26 of the specification).

Claim 9 depends from claim 6 and further recites that the second coil is cascaded with the first coil (page 6, lines 21-26 of the specification).

Independent claim 10 recites a MRI coil array that comprises a first solenoidal coil 12 having a first section (first coil section A) and a second section (second coil section B), with the first section having more turns than the second section (page 4, lines 16-18 of the specification). The second section has a counter-rotational orientation with respect to the first section (page 5, lines 18-19). The MRI coil array further comprises a second solenoidal coil 14 oriented with respect to the first coil to reduce coupling and wherein the second coil is oriented about the

second section (page 5, lines 3-6 and page 6, lines 21-26 of the specification).

Independent claim 11 recites a MRI coil array that comprises a first solenoidal coil 12 having a first section (first coil section A) and a second section (second coil section B), with the first section having more turns than the second section (page 4, lines 16-18 of the specification). The second section has a counter-rotational orientation with respect to the first section (page 5, lines 18-18). The MRI coil array further comprises a second solenoidal coil 14, with the second coil being oriented with respect to the first coil to reduce coupling (page 5, lines 3-6 of the specification). The second coil is cascaded with the first coil (page 6, lines 21-26 of the specification).

Claim 12 depends from claim 6 and further recites an orthogonal coil forming a quadrature pair with each of the solenoidal coils (page 7, lines 28-30 of the specification).

Claim 13 depends from claim 1 and further recites that the second coil is placed near the null  $B_1$  point (page 5, lines 3-4 of the specification).

Claim 14 depends from claim 1 and further recites that the first coil comprises a plurality of winding sections with the  $B_1$  field produced by one winding section stronger than the  $B_1$  field produced by another winding section (page 5, lines 18-22 of the specification).

Claim 15 depends from claim 1 and further recites that the first coil comprises a plurality of winding sections, with the number of the winding sections based on sensitivity parameters (page 5, lines 10-12 of the specification).

Claim 16 depends from claim 1 and further recites that the first coil comprises a plurality

of winding sections and at least one of (i) a separation between the winding sections and (ii) a diameter of the winding sections is based on sensitivity parameters (page 5, lines 23-27 of the specification).

Claim 17 depends from claim 1 and further recites that the second coil is positioned relative to the first coil based on  $B_1$  field strength (page 5, lines 9-12 and page 6, lines 7-18 of the specification).

Independent claim 18 recites a method for providing a MRI coil array that comprises configuring a first coil 12 having a null  $B_1$  point and a quasi-one-peak sensitivity profile with only one peak (page 4, lines 15-17 and page 4, line 30 to page 5, line 2 of the specification; and Fig. 2D). The method further recites configuring a second coil oriented with respect to the first coil to reduce coupling (page 5, lines 3-6 of the specification).

Claim 19 depends from claim 18 and further recites that the second coil overlaps the first coil (page 6, lines 21-26 of the specification).

Claim 20 depends from claim 18 and further recites that the second coil is cascaded with the first coil (page 6, lines 21-26 of the specification).

**VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

A. Claims 1-20 stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting over co-pending Application Nos. 10/283,213, 10,283,292 and 09/935,705.

B. Claims 1-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Su et al. (U.S. Patent 6,493,572) (hereinafter “Su”).

## VII. ARGUMENT

Applicants respectfully submit that each pending claim in the pending application is patentable over the cited art. Accordingly, Applicants respectfully traverse the rejection of the pending claims, and requests that the final rejection be withdrawn and that the pending claims be allowed. In support of these requests, a discussion regarding the patentability of the claimed recitations is set forth below.

### A. The Provisional Rejection of Claims 1-20 is Acknowledged

The provisional rejection of claims 1-20 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-25 in co-pending U.S. Patent Application Nos. 10/283,213, 10/283,292 and 09/935,705 is acknowledged. However, claims 1-25 in these applications have not issued in U.S. Patents and, thus, Applicants are not required to respond until said claims issue.

### B. Claims 1-20 Are Not Unpatentable Over Su

Claims 1-20 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Su. This rejection was made final in an Office Action dated July 27, 2005.

Applicants submit that Su does not teach or suggest the recitations of independent claims 1, 6, 10, 11 and 18. Claims 1, 6 and 18 recite an MRI RF coil array that comprises a first coil having a quasi-one-peak sensitivity profile with only one peak. In the Final Office Action, the Office asserts that because the current claim language uses the open term “comprising,” the claim does not exclude a profile with more than one peak as disclosed in Su. The Office further

asserts that it would have been obvious to one skilled in the art at the time the invention was made that Su teaches a null “with only one peak” because the reference teaches a null and two peaks, thereby including two of “only one peak.” These assertions ignore the recitation of “only” in these claims and further fail to show any suggestion to provide a quasi-one-peak sensitivity profile with only one peak.

Su et al. describes an inherently de-coupled sandwiched solenoidal array coil (SSAC) for use in receiving nuclear magnetic resonance (NMR) radio frequency (RF) signals in both horizontal and vertical-field magnetic resonance imaging (MRI) systems (see abstract of Su). The SSAC includes a receive coil 1 consisting of two loop or solenoidal sections 1a and 1b that are spatially separated by distance W. The two loop or solenoidal sections may consist of either single or multiple conductive windings (turns) and are electrically connected by a pair of parallel conductors 1c and 1d, such that an electrical current (i) in coil 1 flows clockwise in section 1b but counterclockwise in section 1a or vice versa (column 6, lines 38-49).

Further, the SSAC includes receive coil 2, which also may be a single-turn loop or a multiple-turn solenoid, and is “sandwiched” between sections 1a and 1b of the gradient-field arrangement of coil 1 to form an RF coil array. The separated sections of coil 1 are electrically connected and positioned so that a current in coil 1 flows in opposite circumferential directions through the conductive windings in sections 1a and 1b such that magnetic fields generated from sections located at opposite sides (axial ends) of the coil achieve a null at the location of coil 2. This structural configuration provides an inherent “decoupling” of the two coils when used together as an array for receiving NMR signals (column 6, lines 50-67).

The SSAC disclosed in Su has an “M” shaped sensitivity profile with two peaks having a null in between as shown in Fig. 2D of Su. This profile shows the sensitivity of the coil 2, which has counter-rotational portions (column 7, lines 53-57 of Su). The peak of coil 1 of the SSAC disclosed in Su must be located between the two peaks of the “M” shaped profile to achieve the desired coupling.

In contrast claims 1, 6 and 18 recite a coil of a coil array having a sensitivity profile with “only one peak” as illustrated in Fig. 2D of the pending application and showing a null with only one peak. This sensitivity profile allows the coil arrays shown in Figs. 4-6 of the pending application to function effectively.

Applicants and the Office do not disagree as to what Su discloses. Both the Applicants and the Office agree that Su only describes a coil array having a sensitivity profile with two peaks. Thus, the issue presented with respect to claims 1-20 is whether the claimed recitation of “only one peak” is obvious by the two peak profile disclosed in Su. To assert that the two peak profile of Su teaches the recited claim language of “only one peak” ignores the plain language of the claims and is clearly contrary to established law regarding claim construction. There is simply no teaching or suggestion in Su for such a profile.

The law is clear, and the Federal Circuit has repeatedly held that an indefinite article such as “a” or “an” when recited in an open-ended claim containing the transitional phrase “comprising” is construed to mean “one or more” *unless the claim is specific as to the number of elements*. Scanner Technologies Corp. v. ICOS Vision Systems Corp., 70 USPQ2d 1900, 1904 (Fed. Cir. 2004)(emphasis added). The claim construction inquiry begins and ends in all cases with the actual words of the claim. Id.



Further, the law is clear that use of the term “only” limits the scope of the claim language to exclusively what is claimed in connection with the term “only.” Elekta Instrument v. O.U.R. Scientific Int’l, 54 USPQ2d 1910, 1913 (Fed. Cir 2000). The Federal Circuit made clear in *Elektra* that use of the term “only” unambiguously limits a claim exclusively to that which the term modifies, in that case, to a range of values. Id. In *Elektra*, the claims were amended to include “only” to be exclusionary, and in particular, to be “only within a zone” to overcome prior art outside the zone. Id. at 1914.

The pending application recites in amended claims 1 and 6, a sensitivity profile having “only one peak,” thereby clearly specifying the number of peaks in the sensitivity profile, namely one, and only one. Therefore, the claimed sensitivity profile is not taught or suggested by a reference having more than one peak. To interpret the claim any other way would disregard a recitation expressly set forth in the claims. For example, the CCPA has held that a claim reciting means responsive to flow through one inlet orifice reads on means responsive to flow through two orifices because flow through two includes flow through one. In re Teague, 117 USPQ 284, 289 (CCPA 1958). In contrast to claims 1 and 6 that recite “only one peak,” the holding in *Teague* was reached because the claim did not recite “only one” and therefore must be construed to mean “at least one.” Id.

“When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references.” In re Rouffet, 149 F.3d 1350, 1355 (Fed. Cir. 1998). The prior art as a whole must suggest the desirability of the combination, not that combination is the most desirable available. It is improper to disregard or ignore a claim recitation when making such a rejection. Claims 1 and 6 recite a sensitivity profile with “only

one peak.” Only is defined as “one alone; single.” Webster’s Revised Unabridged Dictionary, 1913 Edition. Although a reference disclosing a sensitivity profile having two peaks may teach a sensitivity profile having “one peak,” it does not teach a claim reciting a sensitivity profile having “only one peak.” To interpret the claim in such a manner would totally ignore the claim language and is contrary to the ordinary meaning of the word “only.” To interpret a sensitivity profile having two peaks to teach and suggest a sensitivity profile having “only one peak” without any more support for such a teaching is improper. Further, it is impossible and illogical to have a sensitivity profile defined by two peaks include two of “only one peak” because the “only” necessarily limits the number of peak to one and not more than one. Su does not describe or suggest including only one peak. Thus, because claims 1 and 6 include the recitation “only one peak,” the claims cannot be rendered unpatentable by Su and the teachings therein.

Further, as described above, the coil array in Su cannot achieve the desired coupling without the “M” shaped sensitivity profile with two peaks. Thus, Su in fact teaches away from a sensitivity profile having “only one peak.” If art “teaches away” from a claimed invention, such a teaching supports the nonobviousness of the invention. U.S. v. Adams, 148 U.S.P.Q. 479 (1966); Gillette Co. v. S.C. Johnson & Son, Inc., 16 U.S.P.Q.2d 1923, 1927 (Fed. Cir. 1990).

Neither the foregoing discussion of Su, nor any other written text or graphical illustrations within Su, renders claims 1 6 or 18 obvious.

Claims 2-5, 7-9, 12-17 and 19-20 depend from claims 1, 6 and 18 and are likewise patentable over Su based at least on their dependency from claims 1, 6 and 18.

For reasons set forth above, it is respectfully submitted that the Su patent does not teach or suggest the claim recitations of claims 1, 6 and 18, and therefore does not render these claims unpatenable.

Claims 10 and 11 recite an MRI coil comprising “a first solenoidal coil having a first section and a second section, said first section having more turns than said second section and said second section having a counter-rotational orientation with respect to said first section” and “a second solenoidal coil, said second coil being oriented with respect to said first coil to reduce coupling, wherein said second coil is oriented” either about said second section or cascaded with said first coil.

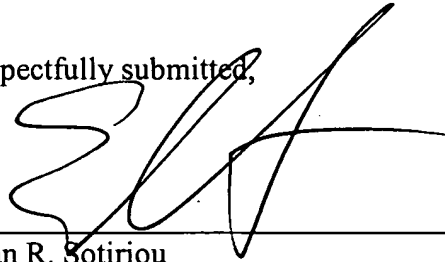
Applicants submit that Su fails to describe the coil arrangement as recited in these claims. Su does not teach or suggest a second coil oriented about a second section or cascaded with a first coil. The Office Action merely makes a broad assertion that the several orientations of coils are presented, including overlapping and cascading configurations and that the alternative coil configurations are well known functional equivalents. The Office Action fails to specifically set forth where Su discloses these recitations. Therefore, the grounds of rejection have not been clearly developed, are improper, and the finality of such rejection is inappropriate. M.P.E.P. § 706.07.

Accordingly, Applicants respectfully request that the final rejection be withdrawn, and the pending claims allowed. A favorable action is respectfully requested.

*Express Mail No. EV 679303695 US*

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Respectfully submitted,

A handwritten signature in black ink, appearing to read 'E. Sotiriou', written over a horizontal line.

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**VIII. APPENDIX OF CLAIMS INVOLVED IN THE APPEAL**

1. A MRI RF coil array, said array comprising:

a first coil having a null  $B_1$  point and a quasi-one-peak sensitivity profile with only one peak; and

a second coil oriented with respect to said first coil to reduce coupling.

2. A MRI RF coil array according to claim 1, wherein said second coil is within said first coil.

3. A MRI coil array according to claim 1, wherein said second coil overlaps said first coil.

4. A MRI coil array according to claim 1, wherein said second coil is cascaded with said first coil.

5. A MRI coil array according to claim 1, wherein said second coil is solenoidal.

6. A MRI coil array, said array comprising:

a first solenoidal coil having a first section and a second section, said first section having more turns than said second section and said second section having a counter-rotational orientation with respect to said first section, said first coil having a quasi-one-peak sensitivity profile with only one peak; and

a second solenoidal coil, said second coil being oriented with respect to said first coil to reduce coupling.

7. A MRI coil array according to claim 6, wherein said second coil is oriented between said first and second sections.

8. A MRI coil array according to claim 6, wherein said second coil is oriented about said second section.

9. A MRI coil array according to claim 6, wherein said second coil is cascaded with said first coil.

10. A MRI coil array, said array comprising:

a first solenoidal coil having a first section and a second section, said first section having more turns than said second section and said second section having a counter-rotational orientation with respect to said first section; and

a second solenoidal coil, said second coil being oriented with respect to said first coil to reduce coupling wherein said second coil is oriented about said second section.

11. A MRI coil array, said array comprising:

a first solenoidal coil having a first section and a second section, said first section having more turns than said second section and said second section having a counter-rotational orientation with respect to said first section; and

a second solenoidal coil, said second coil being oriented with respect to said first coil to reduce coupling, wherein said second coil is cascaded with said first coil.

12. A MRI coil array according to claim 6, further comprising an orthogonal coil forming a quadrature pair with each of said solenoidal coils.

13. A MRI RF coil array according to claim 1, wherein said second coil is placed near the null  $B_1$  point.

14. A MRI RF coil array according to claim 1, wherein said first coil comprises a plurality of winding sections with the  $B_1$  field produced by one winding section stronger than the  $B_1$  field produced by another winding section.

15. A MRI RF coil array according to claim 1, wherein said first coil comprises a plurality of winding sections, a number of the winding sections based on sensitivity parameters.

16. A MRI RF coil array according to claim 1, wherein said first coil comprises a plurality of winding sections and at least one of (i) a separation between winding sections and (ii) a diameter of the winding sections is based on sensitivity parameters.

17. A MRI RF coil array according to claim 1, wherein said second coil is positioned relative to said first coil based on  $B_1$  field strength.

18. A method for providing a MRI coil array, said method comprising:

configuring a first coil having a null  $B_1$  point and a quasi-one-peak sensitivity profile with only one peak; and

configuring a second coil oriented with respect to said first coil to reduce coupling.

19. A method according to claim 18, wherein said second coil overlaps said first coil.

20. A method according to claim 18, wherein said second coil is cascaded with said first coil.